

**Claims**

1. Apparatus comprising means operable to read sequences of data from a storage device and to edit the same such that a first edit point in a first sequence is linked to a second edit point in a second sequence without  
5 violating constraints imposed by a predefined decoder, wherein each of the stored sequences comprises at least one series of transport packets, the transport packets of a given series including respective continuity counter values each related by predetermined continuity rules to the preceding one, the apparatus comprising means for calculating the magnitude of a  
10 discontinuity in continuity counter values resulting from the linking of said edit points, and means for generating a corresponding number of additional transport packets, each having its own continuity counter value, so as to define an edited sequence of transport packets linking said first and second edit points while complying with said constraints and continuity rules.
- 15 2. Apparatus as claimed in claim 1, wherein at least said first sequence conveys at least one packetised elementary stream whose packets have themselves been subdivided to form said transport packets.
- 20 3. Apparatus as claimed in claim 2, wherein the apparatus is adapted to identify a transport packet whose payload includes a packet boundary, and to generate said additional packet(s) so as to comply with said continuity rules when inserted before the identified packet.
- 25 4. Apparatus as claimed in claim 1, comprising means for outputting said edited sequence of transport packets, including said additional packets, via a digital interface.
- 30 5. Apparatus as claimed in claim 1, wherein the first and second sequences of data each comprise a multiplex of plural packetised elementary

streams, each elementary stream having its own sequence of transport packets.

6. Apparatus as claimed in claim 5, wherein the continuity rules operate  
5 independently for each elementary stream, the apparatus being adapted to generate additional transport packets for each elementary stream in accordance with the magnitude of discontinuity calculated for that stream individually.
- 10 7. Apparatus as claimed in claim 1 wherein the apparatus comprises means for generating and storing in advance of reproduction additional data defining the edit.
8. Apparatus as claimed in claim 1, wherein said first and second  
15 sequences comprise frame-based data including a number of frames which are intra-coded without reference to any other frame of the sequence, and a number of frames which are inter-coded with reference to at least one further frame of the sequence.
- 20 9. Apparatus as claimed in claim 8, wherein the apparatus includes bridge generation means configured to create a bridge sequence of transport packets to link the first and second sequences around said edit points, by selective incorporation of frames from the stored first and second frame sequences and selective re-coding of one or more of the frames within the bridge sequence as  
25 determined by the coding type (intra- or inter-) of the frames from the first and second sequences indicated by the respective edit points.
10. Apparatus as claimed in claim 9 wherein said continuity rules permit a  
30 discontinuity in the edited sequence, at a location followed immediately by certain classes of frame header, and the apparatus is adapted to include such a discontinuity in the bridge sequence, while inserting said additional packets

so as to ensure compliance with the continuity rules prior to entering the stored second sequence.

11. Apparatus as claimed in claim 1, comprising means for storing the  
5 bridge sequence on a record carrier together with said first and second sequences and playlist information.

12. A method of reading sequences of data from a storage device and editing the same such that a first edit point in a first sequence is linked to a  
10 second edit point in a second sequence without violating constraints imposed by a predefined decoder, wherein each of the stored sequences comprises at least one series of transport packets, the transport packets of a given series including respective continuity counter values each related by a predetermined continuity rules to the preceding one, the method comprising calculating the  
15 magnitude of a discontinuity in continuity counter values resulting from the linking of said edit points, and generating a corresponding number of additional transport packets, each having its own continuity counter value, so as to define an edited sequence of transport packets linking said first and second edit points while complying with said constraints and continuity rules.

13. A method of reading sequences of data from a storage device and editing the same as claimed in claim 12 wherein at least said first sequence conveys at least one packetised elementary stream whose packets have themselves been subdivided to form said transport packets.

14. A method of reading sequences of data from a storage device and editing the same as claimed in claim 13, wherein the apparatus is adapted to identify a transport packet whose payload includes a packet boundary, and to generate said additional packet(s) so as to comply with said continuity rules  
30 when inserted before the identified packet.

15. A method of reading sequences of data from a storage device and editing the same as claimed in claims 12, wherein the first and second sequences of data each comprise a multiplex of plural packetised elementary streams, each elementary stream having its own sequence of transport  
5 packets.

16. A method of reading sequences of data from a storage device and editing the same as claimed in claim 15, wherein the continuity rules operate independently for each elementary stream, the apparatus being adapted to  
10 generate additional transport packets for each elementary stream in accordance with the magnitude of discontinuity calculated for that stream individually.

17. A method of reading sequences of data from a storage device and editing the same as claimed in claim 12 wherein the apparatus comprises means for generating and storing in advance of reproduction additional data defining the edit.  
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18. A method of reading sequences of data from a storage device and editing the same as claimed in claim 12 wherein said first and second sequences comprise frame-based data including a number of frames which are intra-coded without reference to any other frame of the sequence, and a number of frames which are inter-coded with reference to at least one further frame of the sequence.  
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19. A method of reading sequences of data from a storage device and editing the same as claimed in claim 18, including creating a bridge sequence of transport packets to link the first and second sequences around said edit points, by selective incorporation of frames from the stored first and second  
25 frame sequences and selective re-coding of one or more of the frames within the bridge sequence as determined by the coding type (intra- or inter-) of the  
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frames from the first and second sequences indicated by the respective edit points.

20. A method of reading sequences of data from a storage device and  
5 editing the same as claimed in claim 19 wherein said continuity rules permit a  
discontinuity in the edited sequence, at a location followed immediately by  
certain classes of frame header, and the apparatus is adapted to include such  
a discontinuity in the bridge sequence, while inserting said additional packets  
so as to ensure compliance with the continuity rules prior to entering the stored  
10 second sequence.

21. A method of reading sequences of data from a storage device and  
editing the same as claimed in claim 12 comprising means for storing the  
bridge sequence on a record carrier together with said first and second  
15 sequences and playlist information.

22. A recording carrying first and second frame data sequences together  
with one or more bridge sequences whereby a first edit point in a first frame  
sequence is linked to a second edit point in a second frame sequence, said  
20 bridging sequence having been generated by a method as claimed in claim 12.

23. Data reproducing apparatus comprising reproducing means operable in  
response to stored edit data to read from a storage device first and second  
sequences of data, the edit data linking a first edit point in the first sequence to  
25 a second edit point in a second sequence so as to output a desired edited  
sequence, wherein said first and second sequences each comprise at least  
two multiplexed elementary streams encoded and multiplexed in a form  
compliant with a predefined decoder specification such that truncating said first  
sequence at said first edit point and entering said second sequence at said  
30 second edit point would potentially violate one or more constraints within said  
decoder specification, said reproducing means operating substantially without  
recoding or re-multiplexing of said elementary streams by reproducing data

selectively from said first and second sequences in the vicinity of said edit points, such that said edited sequence, as output, complies with said decoder specification.

5 24. Apparatus as claimed in claim 23, wherein at least one of said elementary streams in the first sequence comprises frame-based data in which a number of frames (hereinafter "I-frames") are intra-coded, without reference to any other frame of the sequence, a number (hereinafter P-frames") are respectively coded with reference to one further frame of the sequence, and  
10 the remainder (hereinafter B-frames") are respectively coded with reference to two or more further frames of the sequence, and wherein said reproducing means includes means for identifying an exit point by reference to the location of said first edit point and to the coding type of frames in the vicinity indicated by said first edit point, and suppressing reproduction of frames of the first  
15 sequence after said exit point.

25 25. Apparatus as claimed in claim 24, wherein said exit point is chosen as the a frame boundary in the data stream prior to the first edit point and immediately prior to an I- or P-frame, in terms of stream order as opposed to  
20 presentation order.

26. Apparatus as claimed in claim 24, wherein said exit point is identified using characteristic point information stored separately from the stream data.

25 27. Apparatus as claimed in claim 24, wherein said at least one elementary stream comprises video frame data, and a further elementary stream within each of said first and second sequences comprises audio frame data, said reproducing means being arranged to use presentation time information within the elementary streams to suppress output of any audio frame data having a  
30 presentation time later than the presentation time of the video frame at said exit point.

28. Apparatus as claimed in claim 23, wherein at least one of said elementary streams in the second sequence comprises frame-based data in which a number of frames (hereinafter "I-frames") are intra-coded, without reference to any other frame of the sequence, a number (hereinafter  
5 P-frames") are respectively coded with reference to one further frame of the sequence, and the remainder (hereinafter B-frames") are respectively coded with reference to two or more further frames of the sequence, and where said reproducing means includes means for identifying an entry point by reference to the location of the second edit point and to the coding type of frames in the  
10 vicinity indicated by said second edit point, and suppressing reproduction of frames of the second sequence prior to said entry point.

29. Apparatus as claimed in claim 24, wherein said entry point is identified using characteristic point information stored separately from the stream data.  
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30. Apparatus as claimed in claim 24, wherein said at least one elementary stream comprises video frame data, and a further elementary stream within each of said first and second sequences comprises audio frame data, said reproducing means being arranged to use presentation time information within  
20 the elementary streams to suppress reproduction of any audio frame having a presentation time earlier than the presentation time of the video frame at said entry point.

31. Apparatus as claimed in claim 27, wherein said suppression of said  
25 audio frames is implemented by modifying codes within packets of audio data, rather than removing them from the multiplex.

32. Apparatus as claimed in claim 31 wherein audio data is suppressed so as to promote a gap in availability of audio data in preference to an overlap of  
30 audio data from the first and second sequences.

33. Apparatus as claimed in claim 23 comprising means for calculating an offset between time-bases of the first and second sequences in accordance with encoded presentation time values and frame update rate.

5 34. Apparatus according to claim 33 wherein said reproducing means is arranged to calculate relative buffer fullness between the exit point of the first sequence and the entry point in the second sequence, in its original form, and to delay entry into the second sequence if necessary to prevent buffer overflow in accordance with buffer constraints of said decoder specification.

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35. Apparatus according to claim 34 wherein said reproducing means is arranged to implement said delay by increasing the calculated offset between time-bases iteratively, until the relative buffer fullness satisfies a compatibility criterion, and then to use the increased offset to generate the edited  
15 sequence.

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36. Apparatus according to claim 33, wherein said reproducing means is arranged iteratively to calculate relative buffer fullness between the exit point of the first sequence and the entry point in the second sequence, in its original  
20 form, and to modify at least one of the entry and exit points until the relative buffer fullness satisfies a compatibility criterion, and then to use the modified entry and exit point, if any, for generating the edited sequence.

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37. Apparatus as claimed in claim 33, wherein said reproducing means is  
25 further arranged to calculate of loading times for data of the first and second sequence, using encoded decode time stamps and the calculated offset between time-bases, to identify instances of overlapping load times as to prevent buffer underflow, and to modify said offset in the event that said calculations imply a loading time for data of the second sequence prior to  
30 completion of loading data of the first sequence.

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38. A method of reproducing stored data, wherein first and second sequences of data stored are read from a storage device and reproduced, in accordance with pre-stored edit data linking a first edit point in the first sequence to a second edit point in a second sequence, so as to output a  
5 desired edited sequence, wherein said first and second sequences each comprise at least two multiplexed elementary streams encoded and multiplexed in a form compliant with a predefined decoder specification such that truncating said first sequence at said first edit point and entering said  
10 second sequence at said second edit point would in general violate one or more constraints within said decoder specification, said reproducing means operating substantially without recoding or re-multiplexing of said elementary streams by reproducing data selectively from said first and second sequences in the vicinity of said edit points, such that said edited sequence, as output, complies with said decoder specification.

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39. A signal reproducing an edited data sequence produced by a method as claimed in claim 38.